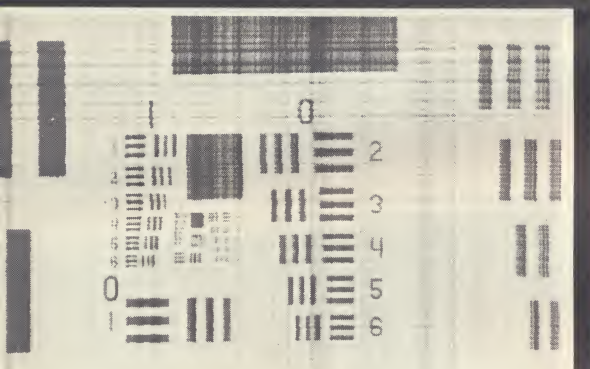


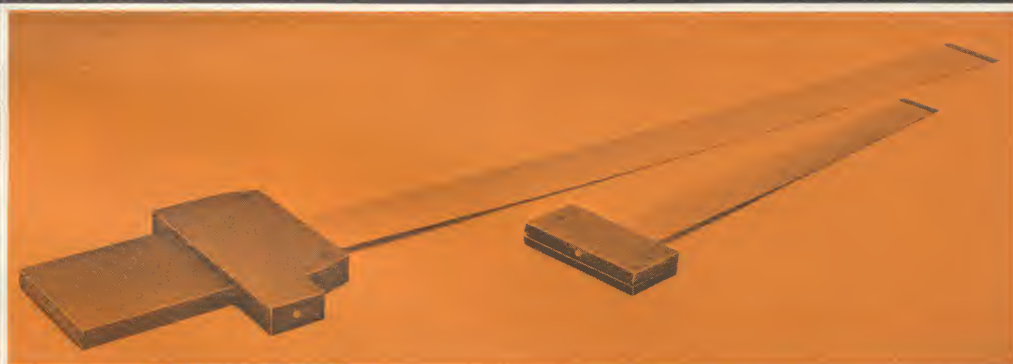
Inspection Probes for Scanning and Recording

Mosaic Fabrications' inspection probes are designed using the principles of fiber optics and total internal reflection for examination of inaccessible cavities. The probe is a bi-layer device using one layer for illumination and the other for imaging.

Applications Fiber optics inspection probes are used for a variety of inspection situations, including the walls of nuclear reactor components and solid rocket motor interiors. A specially modified 35 mm recording camera can be attached to the probe. The film movement is synchronized to the probe movement during operation, providing necessary scanning motion. This system yields a 35 mm negative that indicates the condition of the inspected wall. Standard models are for flat surface inspection only. Non-standard models include cylinder inspectors, and flexible probes. Suitable cameras can be recommended by Mosaic Fabrications.



Photograph of USAF Test Chart (1951) using
low resolution probe



Specifications of Standard Models

Fiber Diameter	
Low Resolution: .....	.004" x .004" nominal
High Resolution:	15 μ nominal
Numerical Aperture: .....	.45
Spectral Response:	4500 \AA to 8000 \AA
Temperature Rating:	250° F
Lengths:	to 72"
Widths:	to 5"
Thickness:045" min.
Sheath:	stainless steel

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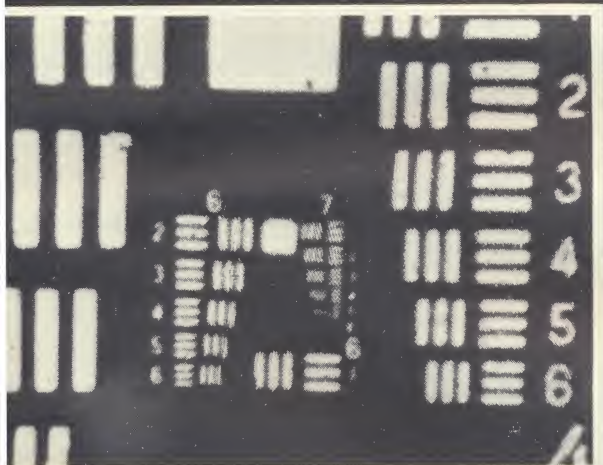


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Fiber Optic Faceplates

Mosaic Fabrications' Fiber Optic Faceplates can replace any ordinary glass viewing port in a vacuum envelope. In this application, they are nearly equivalent to a zero thickness window. Structurally, they consist of millions of optical fibers bonded together by their glass claddings to form a vacuum tight plate with thermal and mechanical properties nearly identical to solid glass.

Applications Face plates are being used now in special orthicons, vidicons, cathode ray tubes, storage tubes and image intensifiers. In all of these applications the basic function of the fiber optics is to transport an image into or out of the vacuum enclosure, but the fiber optics may additionally be used for field flattening, distortion correction, ambient light suppression or control of angular distribution*.



Photograph of USAF Test Chart through a 3 micron N.A. 1.0 fiber optic faceplate, maximum resolution: 160 LP/mm



Availability In order to meet various requirements, Mosaic Fabrications stocks a wide variety of semi-finished faceplates. This stock can be readily cut and finished to customer specifications. Common geometrics include round, square, rectangular and strip. Either or both surfaces can be ground plano or to a specified spherical surface. Standard plates are available up to 5" square**.

*Distortion plates and field angle corrective plates are made only to special order.
**Sizes to 12" diameter can be obtained on special order.

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Specifications of Standard Materials

GLASS TYPE	K-2		D-5	D-8		D-11	D-11	D-11
Numerical Aperture (Nominal)	.66		.86	1.0		.93	.95	1.0
Fiber Size	8μ CLEAR	8μ EMA (1)	8μ EMA	7μ EMA	15μ EMA	5μ CLEAR	7μ EMA	15μ EMA
Coefficient of Expansion ($\times 10^{-7} \text{ }^{\circ}\text{C}$)	93-95		91-93	85-87	87-89	96-98	91-93	94-96
Packing Fraction	70%		73%	70%	76%	75%	75%	80%
Transmission (2)								
Lambertian	—	28%	45%	55%	65%	—	50%	65%
Collimated	—	70%	70%	70%	75%	—	75%	75%
Resolution (LP/mm)	60		60	70	33	100	70	33
Maximum Temp ($^{\circ}\text{C}$) (3)	460		525	550		525	525	525
Chemical Stability	CLASS 2		CLASS 3	CLASS 1		CLASS 1	CLASS 1	CLASS 1
Chemical Compatibility	PHOSPHOR		PHOSPHOR	PHOTO-CATHODE		PHOTO-CATHODE	PHOTO-CATHODE	PHOTO-CATHODE
Sealing Method	FRIT TO KG 12 GLASS		FRIT TO 0041 GLASS	FRIT TO CARP. 49 ALLOY		FRIT TO KG 12 GLASS	FRIT TO KG 12 GLASS	FRIT TO KG 12 GLASS
Annealing Schedule (5)	C		C	A		B	B	B
Spectral Transmission (4)	90% @ 3500 Å		90% @ 3900 Å	90% @ 4000 Å		90% @ 4000 Å	90% @ 4000 Å	90% @ 4000 Å

- (1) EMA, extra-mural absorption = opaque second cladding used to eliminate uncondacted light, maintaining contrast and resolution
- (2) Middle of the visible region, typical values only
- (3) Maximum probable safe temperature for 1 hour; not guaranteed above 450° C
- (4) Data normalized for 100% transmission at the center of the visible region and does not account for packing fraction, fresnel end losses etc.
- (5) Schedules are available from manufacturer

Chemical Stability Classification:

- Class 1. Glass weathers well; will not discolor when heated in a strongly reducing atmosphere. Glass can be cleaned with most standard organic cleaners, and with Nitric or Hydrochloric Acid (20% solution) for ½ hour at room temperature. Weak bases such as ammonia can also be used for cleaning. Glass is attacked by Hydrofluoric acid and strong bases like Sodium Hydroxide.
- Class 2. Weathers well. Surface will discolor slowly when heated in a strongly reducing atmosphere. Glass can be cleaned with Nitric or Hydrochloric acid (20% solution) for 10 minutes at room temperature. Weak bases such as ammonia can be used for cleaning. Glass is attacked by Hydrofluoric acid and strong bases like Sodium Hydroxide.
- Class 3. Weathers poorly. Surface will be attacked by water. Standard organic cleaners can be used. No acid or basic cleaners are recommended. Repolishing of the surface immediately before use is recommended. An alternate solution in the form of a special ½ micron glass overlay for surface protection can be provided if desired.

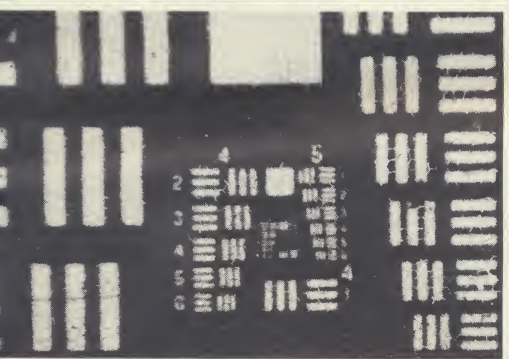
Flexible Imagescopes

The Mosaic Fabrications Imagescope is fabricated of thousands of small (10-12 micron) clad optical fibers, perfectly aligned to transmit a high resolution image from end to end.

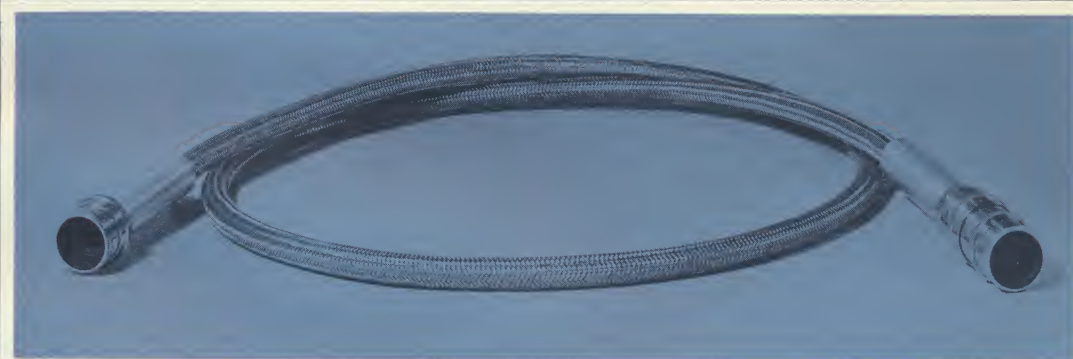
Through the use of hexagonal fibers and multi-fibers — made possible by unique fabrication processes developed by Mosaic — the most accurate fiber alignment, and the lowest possible fiber breakage is obtained. Resolutions attainable with the Imagescope are equal to those predicted by theory for any given fiber size.

Applications The Mosaic Imagescope is designed for visual inspection of remote, inaccessible or hazardous areas such as machinery interiors, weld beads, unshielded reactor components, linings and valves in pipes and tubing, for use as a medical diagnostic tool, in star tracking, etc.

The flexible image guide section is sheathed in a variety of materials to suit it to particular environmental conditions. All Imagescopes are available with a variety of relay lenses, objectives and eyepieces, including right angle viewing devices. We maintain stocks of Imagescope elements, complete except for packaging, for prompt delivery. In addition to the models carried in stock, as specified in this bulletin, we can produce Imagescopes to your special requirements of length, diameter and cross section.



U.S.A.F. (1951)
Resolution Test Chart photographed through
a Mosaic Fabrications Imagescope.



Specifications of Standard Models

Fiber diameter:	10 microns nominal
Bundle diameter:	from .030" to .50"
Resolution: *	45 optical line pairs per mm
Breakage:	1% maximum
Numerical aperture: .....	.55 nominal
Spectral response: .....	.40 to .85 microns
Sheathing:	<ul style="list-style-type: none"> • Polyvinylchloride (PVC) • Stainless steel with PVC covering • Stainless steel braid with Teflon liner
Length:	From 1½ inches to 6 feet in increments of 1 inch or less, as required.

*Not theoretical maximum, but normal recognition of standard USAF Test Chart.



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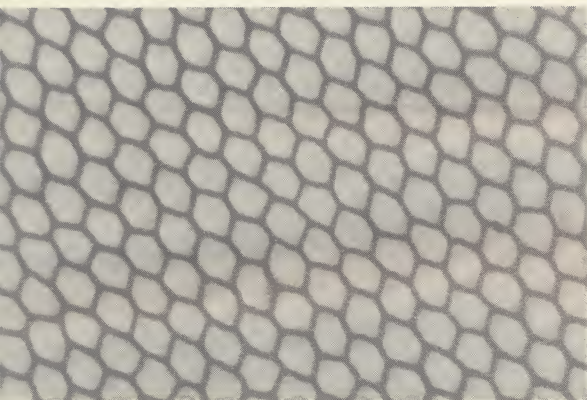
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Rigid Image Conduit

Mosaic Fabrications rigid image conduits are bundles of fused-clad optical fibers, spatially arranged to transmit an image from surface to surface.

Applications Data handling where the transmission of alpha-numeric characters is required. Image conduit can be heated and shaped to various configurations without damage to the fibers. Conduit can also be used as a light pipe in applications where maximum packing fraction is essential, and flexibility is not mandatory. A degree of flexibility for specialized applications can be obtained through the use of optically coupled rotating joints.



Microphotograph of fused image conduit,
15 fiber diameter



Specifications of Standard Materials

GLASS TYPE	A-7	A-2	K-1	D-8
Numerical aperture	.35	.55	.66	1.0
Fiber diameter	20 μ	10 μ 20 μ .004"	10 μ 20 μ	3 μ 15 μ

Diameter:020" to 2.0"

Geometry: round, square, hex

Length:010" to 6'

Transmission losses: approx. 10% per foot @ 5500 Å*

Finish: ground and polished flat

*D-8 type glass has poor transmission in lengths greater than 6"

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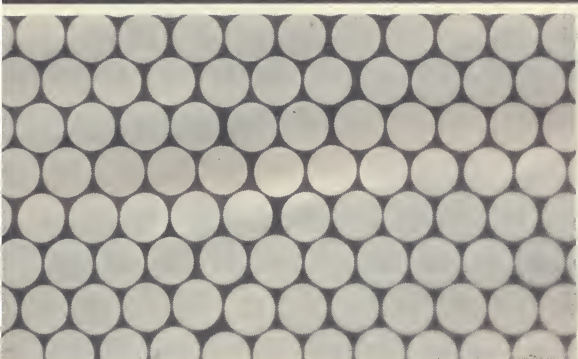
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Flexible Light Guides

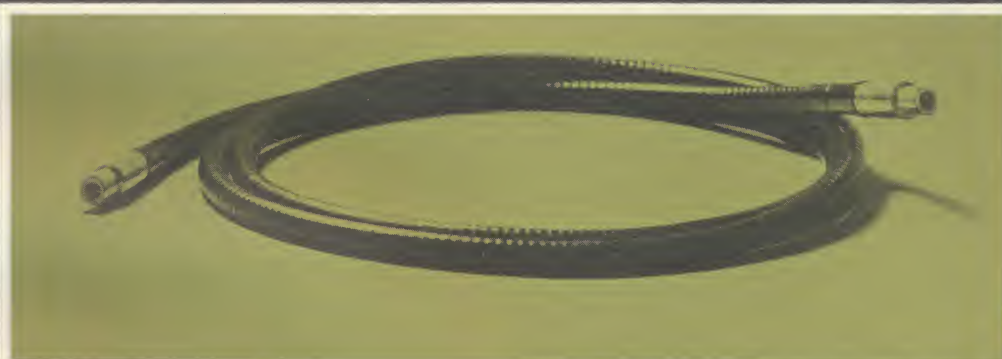
Mosaic Fabrications' Flexible Light Guides are bundles of clad optical glass fibers which transmit light from one end to the other by total internal reflection.

Applications Flexible light guides are used in applications such as data processing, fire detection, control systems, scanning systems, counting and sizing. They are used in situations where it is not desirable to have the light sources at the location where illumination is needed, such as in hazardous or explosive areas where heat or a spark cannot be tolerated. Where reliability is lessened by the need for multiple light sources, it can be improved by a single light source with multiple light conduits.

The variety of fiber optics materials and unique fabricating techniques developed by Mosaic offer a wider range of useful characteristics than is available with any other light guides currently being produced.



Cross section 75x magnification



Specifications of Models Carried in Stock for Immediate Delivery

Fiber diameter:	0.002" nominal
Numerical aperture:	multiple from .30 to 1.0
Packing fraction:	75% nominal
Transmission losses:	approx. 10% per foot at 5500 Å
Spectral response:	A selection from 0.35 microns to 2.0 microns
Temperature rating:	225°F (temperatures to 800°F available as special order)
Finish:	Ground and polished flat
Standard packaging, sheathing:	Polyvinylchloride (PVC) with metal end fittings
Special packaging, sheathing:	stainless steel armored flex sheath over Teflon

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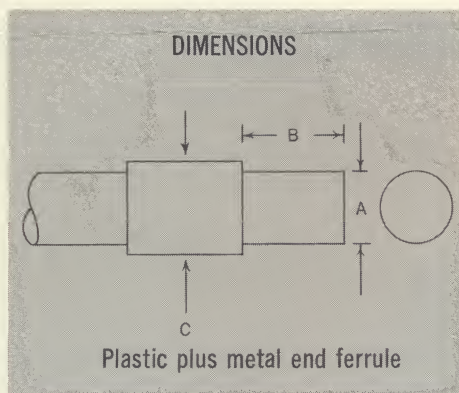
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Mosaic Flexible Light Guides are available in a variety of standard diameters and lengths, and can be packaged in many materials to suit varying requirements. In addition to the models carried in stock for immediate shipment, as specified in this bulletin, we can produce light guides to your special requirements of length, diameter, cross section (round to square, round to rectangle, round to slit, etc.), furcation (single to double, single to quintuple, etc.) and spectral response:

Spectral Response: Mosaic Fabrications' flexible light guides are available with a selection of numerical apertures (.30, .55, .66, .84, 1.00) and color transmissivity to suit special purposes, such as extended red response for fire detectors or extended blue response in the 3500-4000 Å, near-UV range.

Light Pipe Data



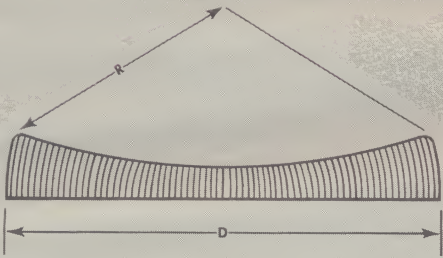
BUNDLE DIA	MIN. BEND RADIUS	METAL			STANDARD LENGTHS & PART NUMBERS					
		A	B	C	12"	24"	36"	48"	60"	72"
1/16"	5/8"	.125	.5	13/64"	125-1500	125-1505	125-1510	125-1515	125-1520	125-1525
1/8"	3/4"	.187	.5	1/4"	125-1530	125-1535	125-1540	125-1545	125-1550	125-1555
3/16"	1"	.250	.5	5/16"	125-1560	125-1565	125-1570	125-1575	125-1580	125-1585
1/4"	1 1/2"	.312	.5	27/64"	125-1590	125-1595	125-1600	125-1605	125-1610	125-1615
5/16"	2"	.437	.5	35/64"	125-1620	125-1625	125-1630	125-1635	125-1640	125-1645
1/2"	3"	.562	.5	43/64"	125-1650	125-1655	125-1660	125-1665	125-1670	125-1675

Larger Diameters and longer lengths available as special order parts.

Fiber Optic Field Flatteners

Mosaic Fabrications makes two types of field flattener. The simpler type consists of a face plate as described in a separate brochure with specified curvature on one or both surfaces. In many applications, this type of fiber optic plate has a disastrous effect on angular distribution of light. The second type of field flattener has field angle correction within wide limits. Any spherical correction can be obtained at both surfaces with reasonable precision.

Applications Fiber optic field flatteners are used to match the field curvature of optical to electron optical systems and to match the field curvatures of two parts of an optical system. By allowing the electron optical or lens designer the freedom of arbitrary field curvature, one may be able to reduce aberrations substantially.



Cross-sectional view of Field Flattener with field angle correction



Availability Simple field flatteners may be machined from stock face plates. Field flatteners with angular correction must be made to special order. The general specifications of these special plates are shown below.

Specifications

Diameter:	.....	.5" to 5"
Correction available:	.....	from ∞ to a minimum of .7 of the plate diameter
Accuracy:	.....	10%
Configuration:	standard plate is plano-concave (see diagram)
Fiber size:	10 μ clear and 15 μ EMA

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